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(58) Field of search
B5N

(54) **Import resistant fuel tanks**

(57) A tank having a wall construction comprising an inner layer of aluminium, a second layer of epoxy resin, a third layer of glass fibre reinforced polyester resin, a fourth layer of kevlar fibre reinforced plastic material an outer layer of glass fibre reinforced polyester resin and an outermost coating of a fire retardant material. The interior of the tank is filled with a lattice like material for preventing liquid stored within the tank from forming a mist, if the tank should be erupted.

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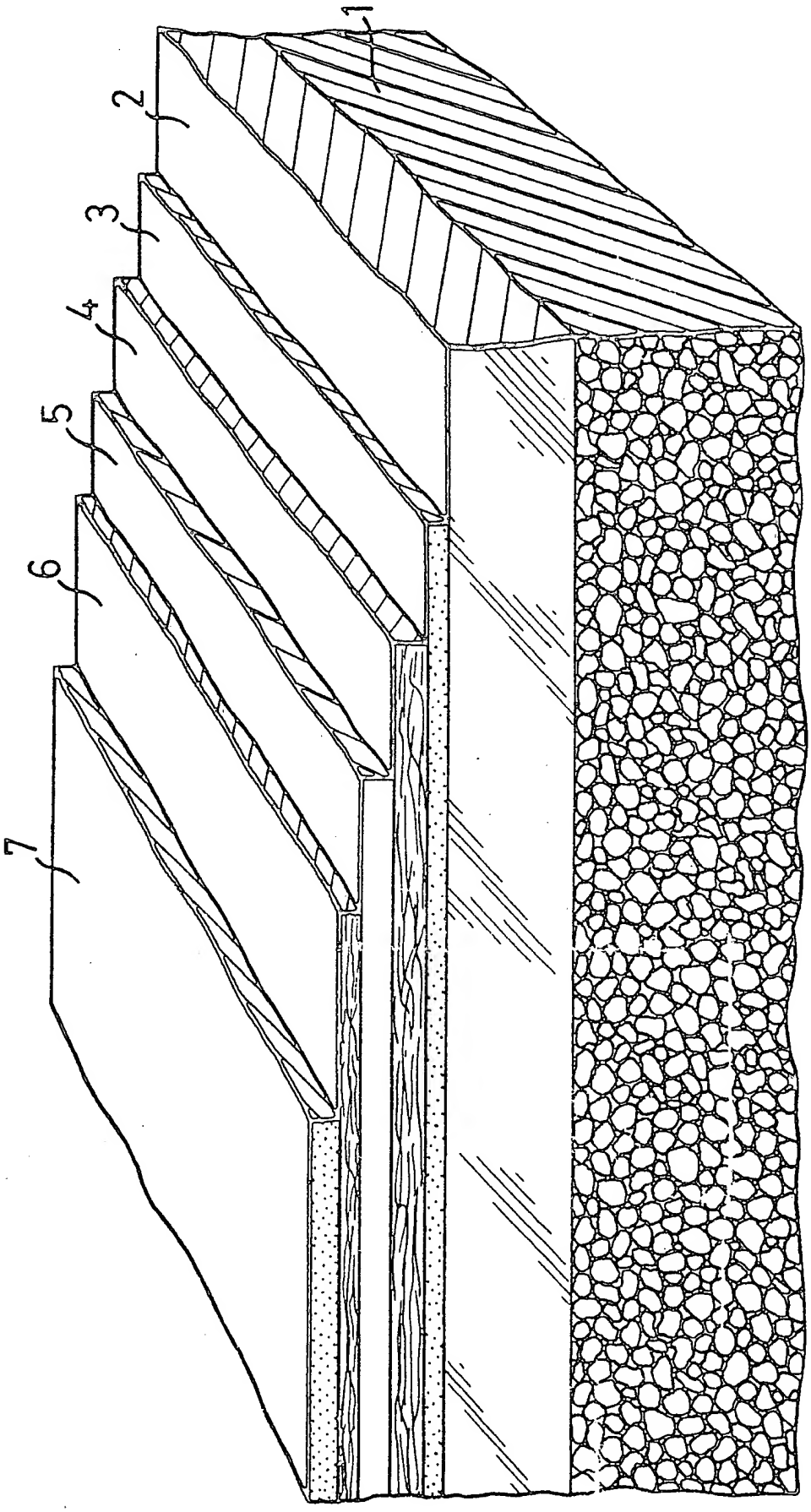

SPECIFICATION

An improved tank construction

Description

This invention relates to an improved tank construction. In particular the present invention relates to a tank or container for holding a hazardous or flammable liquid. An example of such a tank or container is a fuel cell for accommodating a liquid fuel, such as a petroleum distilate, located within the body of an air, sea or land vehicle.

In the event of a vehicle, such as a motorcar, being involved in an accident which results in the rupturing of a fuel cell located within the vehicle, there is a grave risk that any fuel spilt from the ruptured fuel cell will catch fire. In order to minimise this risk, fuel cells or tanks are not located where they would be exposed to damage in an accident. However, in a serious accident involving a heavy impact, wherever a fuel cell is placed in a vehicle it may still be damaged through being struck directly by a hard object, or through being crushed by the vehicle's structure, if the latter is caused to deform.

Accordingly in vehicles which are at greater risk to damage, such as racing and other competition cars, fuel cells with enhanced resistance to be rupturing are employed. For example whereas a fuel cell would conventionally comprise a hollow container formed from sheet metal, competition cars are often fitted with tanks which comprise a flexible bag formed from a plastics material and located within a hollow rigid box section, which forms part of the vehicle's structure. The fuel being located within the bag. In the event of an accident in which the box section containing such a bag tank is crushed or penetrated, the bag tends to be deformed rather than be penetrated itself. However the bag will eventually burst if it is crushed with sufficient pressure or impailed upon a sufficiently sharp object. Additionally bag tanks, unlike conventional sheet metal tanks, tend to degrade in use and may in time begin to leak fuel.

According to the present invention there is provided a tank or container, the walls of which comprise at least one inner layer of metal and one further layer of kevlar fibre reinforced plastics resin.

An advantage of a tank in accordance with the present invention is that, unlike a bag tank, it has a metal lining and therefore it does not degrade in use and thus is highly leak resistant. Furthermore the tank walls have enhanced resistance to penetration by sharp objects and may be subjected to considerable distortion, stress and strain before rupturing.

In an embodiment, the tank walls include at least one further layer comprising a glass reinforced plastics material, and preferably said walls have an outer coating of a fire resistant material. Such an embodiment has the further advantage that the additional layers of glass reinforced plastics serve to spread the load of any impact on the wall, and thus further enhance the tank's resistance to being ruptured. The fire retardant material serves to protect both the tank walls and contents of the tank from the effects of a fire immediately outside the tank.

Finally and in a preferred embodiment, the tank is filled with a lattice like structure for preventing a flammable liquid within the tank from forming a mist, thereby reducing the risk of said liquid being ignited.

A particular embodiment of the present invention will now be described, by way of example only, and with reference to the accompanying drawing.

The drawing shows a scrap sectional view through the wall of a tank in accordance with the present invention.

With reference to the figure, a tank wall comprises six layers extending outwardly from an innermost layer 2 through a second layer 3, a third layer 4, a fourth layer 5, and a fifth layer 6, to an outermost layer 7.

The innermost layer 2 is formed from aluminium, the second layer 3 is formed from epoxy resin, the third layer 4 is formed from glass reinforced polyester resin, the fourth layer 5 is formed from kevlar fibre reinforced plastics material, the fifth layer 6 is formed from glass reinforced polyester resin, and the outermost layer 7 is formed from a fire retarding polyester resin sold under the trade mark 'Crystic Fireguard'.

The interior of the tank is filled with a lattice like polyester material which is sold under the trade mark "Safom type 2". This material prevents fuel within the tank from forming a mist, and thus reduces the risk of an explosion if the tank is ruptured.

The second layer 3 of epoxy resin forms an additional seal in case of any pourosity in the innermost layer 2, and serves to bond the metal of layer 2 to the plastics material of the third layer. The reinforcing mat of glass fibres in the third layer 4 is a "chop strand" mat having a random orientation of fibres. The Kevlar reinforcing fibres in the fourth layer 5, are in the form of a woven mat comprising warp and weft fibres orientated at 90° to one another. The warp and weft of the mat are aligned differently in different parts of the tank walls, so as to give maximum strength to each particular part of each tank wall. The "Crystic Fireguard" material comprising the outermost layer 7, forms a carbonaceous foam when subjected to intense heat, such as that encountered during a fire, and thus in such circumstances forms a thermally insulating layer on the exterior of the tank wall.

In the manufacture of a complete tank, the aluminium innermost layer 2 is mechanically deformed and welded together around the "Safom type 2" filling material 1, to form the basic shell of the tank. The aluminium layer 2 is then coated with the epoxy resin forming the second layer 3, and the further layers 4, 5 & 6 of composite materials are then layed up in sequence. Finally the outermost layer 7 of "Crystic Fireguard" 7 is applied to give the finished tank.

"Kevlar" is a trade mark of the Du Pont Company and is used in connection with fibres formed from the aromatic polyamide, poly (1,4 -phenyleneterephthalamide). The term "kevlar" has been used in this specification to denote a fibrous material spun from poly (1, 4 -phenyleneterephthalamide) or a substantially similar aromatic polyamide.

CLAIMS

1. A tank, the walls of which comprise at least one inner layer of metal and one further layer of kevlar fibre reinforced plastics resin.

2. A tank as claimed in claim 1 wherein the walls comprise at least one further layer of glass fibre reinforced plastics material.

3. A tank as claimed in claim 2 wherein the walls comprise an inner layer of aluminium, a second layer of an epoxy resin, a third layer of glass fibre reinforced polyester resin, a fourth layer of kevlar fibre reinforced plastics material and an outer layer of glass fibre reinforced polyester resin.

4. A tank as claimed in any one of claims 1, 2 and 3 wherein the walls have an outermost coating of a fire retardant material.

5. A tank as claimed in any of the preceding claims wherein the tank is filled with a lattice which in use prevents a liquid from within the tank forming a mist, if the tank should be ruptured.

6. A tank as claimed in any of claims 3, 4 and 5 wherein the glass fibres are in the form of a mat having a random fibre orientation and, the kevlar fibres are in the form of a woven mat comprising warp and weft fibres orientated substantially orthogonally.

7. A tank substantially as hereinbefore described with reference and as shown in the accompanying drawing.

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